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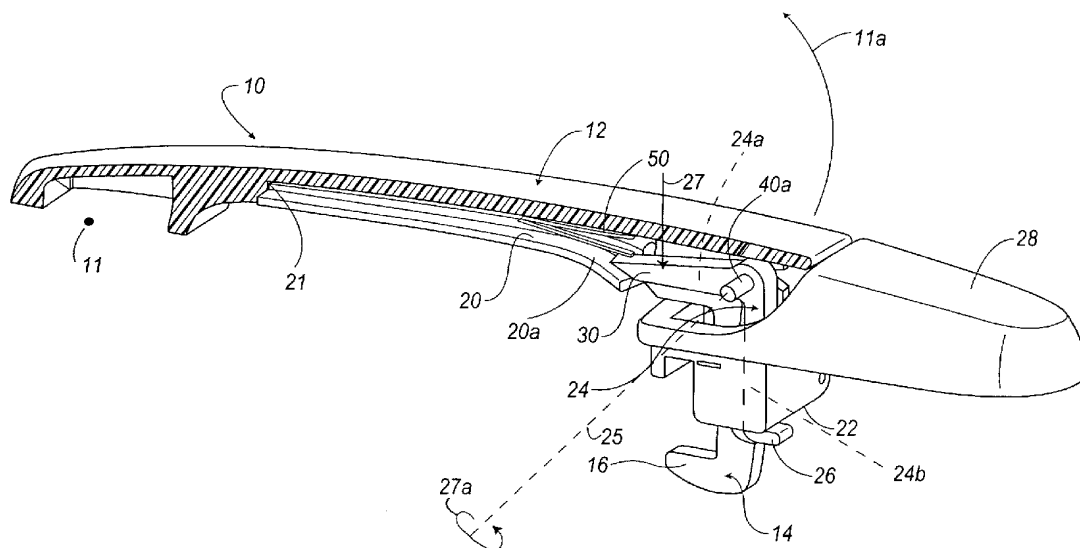
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(54) Title: HANDLE ASSEMBLY WITH DUAL LATCH FEATURE



(57) Abstract: A handle assembly (10) is disclosed. The assembly includes a rotatable, spring handle (12, 120) with a plunger (14, 114) having a first engagement feature or surface (16, 116) for receipt of a spring force; a trigger device (20, 150) in operative connection with the handle; and a blocking member (24, 160) movable with the handle and rotatably mounted on the handle, the blocking member including a latch at a distal end thereof (26, 166). The blocking member is in operative connection with the trigger device and a portion of the latch is retained by a remote retention surface (22) when the assembly is in a locked configuration. Upon sufficient mechanical movement of the trigger device and the blocking member, the latch is no longer restricted by the retention surface.

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-1-

HANDLE ASSEMBLY WITH DUAL LATCH FEATURE

The present invention generally relates to latch mechanisms and more particularly to latch mechanisms for vehicle doors and panels. Latch mechanisms are included in a wide variety of applications, including those involving access panels or doors. In a number of instances, for example, additional features may be employed with door handles for a vehicle to provide added protection or safety. Such additional features can be particularly useful in cases where an impact, such as a side impact or rear impact on a vehicle, may occur. The invention provides, among other things, a supplemental latching mechanism that assists in maintaining the reliability of a primary latching mechanism while preventing inadvertent opening of a door, even in the event of an impact or other significant force occurrence.

The present invention comprises a door handle assembly with a movable handle. In the preferred embodiment the handle is configured to be rotationally mounted to a door at one end of the handle. The handle is spring biased causing the handle to lie against the door (its sheet metal or skin) in a rest position. An end of the handle, opposite its pivot end, is displaceable from the rest position relative to the door and movable to an activated position when the handle is grasped and pulled by a user seeking entry (into the vehicle) through the door.

The spring bias can be realized in a number of ways; in the preferred embodiment of the invention the spring bias of the handle is obtained using a known type of bell crank (a pivoted, double lever mechanism). The handle comprises a projection (an engagement surface) to receive the bias force transmitted by one of the levers of the bell crank. The interface between the mechanism, such as a spring that biases the handle to its rest portion and the handle, can take many forms. The handle bias spring can be directly connected to the handle rather than acting through an intermediary mechanism or engagement surface.

-2-

When the handle is moved sufficiently away from the door, a door latch (sometimes referred to in the art as a door lock) is moved to an open condition and the door is now unlatched and ready to be pulled open. The handle can act directly on the door latch or indirectly through a cable or bar, as the handle and door latch are often remotely located.

The handle assembly includes a blocking member also referred to as a latch member. The blocking member is rotationally fixed in the handle and carried by the handle. The blocking member includes a latch or hook latchable with a fixedly positioned latch surface, wall or feature provided by a cooperating member attached to and movable with the door. The cooperating member is the cap or lock housing of the handle, which is fixedly secured to the sheet metal of the door and functions, in part, as an aesthetic trim part of the handle assembly. The latch surface need not be formed as part of the cap or lock housing but can be a part of the door sheet metal. With the blocking member in place, the door handle cannot be moved from its rest position to open the door.

The handle assembly further includes a spring-loaded activation member (a trigger or trigger device) carried by the handle and in part displaceable relative to the handle and displaceable relative to the blocking member (also carried by the handle). Movement of the activation member moves the blocking member away from the latch surface to a disengage position. The activation member can be directly biased or loaded by a biased spring or indirectly loaded or biased with the spring acting, for example, on the blocking member. With the blocking member dislodged from the latch surface, the door handle is now capable of being pulled away from the door to unlatch the door latch and permit the door to be opened. In the illustrated embodiments of the invention the activation member is configured as a bar or lever rotationally fixed at one end, with the other end of the bar or lever in engagement with an extending lever of the blocking member. The activation member is located on the underside of the handle and depressible inwardly relative to the handle. The

-3-

rotatable activation member can be replaced by a linearly movable button mounted to the underside of the handle, which directly moves the blocking member, or by a combination of a button mounted on the top of the handle and a cooperating lever member that moves the blocking member.

The blocking member can further include an inertial mass, which increases the latching effectiveness of the handle. During a side impact crash in a vehicle, the inertial forces act on the inertial mass, generating a torque that causes the blocking member to be urged against the latch surface preventing the blocking member from becoming dislodged from the latch surface.

Figure 1 is a front perspective view of an assembly with a dual latch feature that embodies teachings of the present invention with a portion of the handle shown in cross section.

Figure 2 is an exploded view of various components of the exemplary assembly illustrated in Figure 1.

Figure 3 is a rear perspective view of the assembly shown in Figure 1, which generally illustrates the second retaining feature in an engaged configuration.

Figure 4 is a rear perspective view of the assembly shown in Figure 1 shown slightly turned and generally illustrating the second retaining feature in an unengaged configuration.

Figure 5 illustrates the major components of an alternate embodiment of the present invention.

Figures 6 and 6a show an alternate embodiment of a second retaining feature.

Figure 7 is longitudinal cross-sectional view of this alternate embodiment.

Figure 8 is a partial assembly view showing a bearing within a portion of the handle about which a second latch member rotates.

Figure 9 shows an alternative embodiment of the invention in which the activation member is configured as a button.

-4-

Referring to Figures 1 - 4, an illustrative embodiment of a handle assembly 10 constructed in accordance with the teachings of the present invention is shown.

Handle assembly 10 includes a rotatable, spring-loaded handle 12 having a plunger 14 with a first engagement feature or surface 16. The plunger 14 and the first engagement feature or surface interface with a bell crank to bias the handle to a rest position. The handle 12 is configured in a known manner to rotate about a center of rotation 11. The direction of rotation of the handle, when pulled by a user, is shown by numeral 11a. The handle 10 and the plunger 14 are preferably of one-piece construction and comprised of metal, plastic, rubber or various combinations of the foregoing elements. However, it should be noted the handle 10 or plunger 14 may be comprised of almost any material configurations and combinations that can provide the necessary function and sufficient durability.

In the first embodiment, the first engagement feature or surface 16 is shown in the form of an L-shaped surface or hook. However, the plunger and first engagement feature or surface are not limited to the illustrated configuration and may instead take on a number of alternate configurations provided the desired latching function can be achieved. The assembly 10 additionally includes an activation member (trigger or trigger device) 20 that is in operative connection with the handle 12. The activation member (trigger device) 20 may be in the form of a movable bar, lever, handle strip or lever grip portion (such as shown), or may instead be comprised of a movable button (see Figure 9) or other actuation mechanism that is lifted, depressed, or otherwise actuated by a user to actuate an associated latch. As shown the activation member 20 is essentially a bar (lever) configured to rotate about its end 21. The activation member 20 can be a separate component in association with the handle 20 (as shown) or, if desired, the activation member 20 can instead be formed integrally with the handle 12. In a preferred

-5-

embodiment, the handle 12 and activation member 20 are configured to resist the intrusion of weather elements therebetween by using tight fitting joints as known in the art.

Figure 8 shows an activation member configured as a movable button 23. In this embodiment the lever-type activation member 20 is replaced by a fixedly positioned support member or plate 23a secured to the underside of handle 12. The support member includes an opening for receipt of a manually depressible button 23. Inward movement (in the direction of arrow 23b) of button 23 causes the blocking member 24 within its latch 26 to uncouple from surface 22.

Returning to Figures 1 and 2, the assembly 10 further includes a blocking or latch member 24 having a retaining feature or latch 26 (latchable with the retention surface 22) latchable with a remote latch or retention surface. As illustrated the latch or retention surface 22 is formed within a mating handle connection component such as a cap 28 (or in lock housing 128 that receives a door key). The latch surface 22 may be part of any sufficiently rigid component or structure to provide a structure or surface for securing or retaining the retaining feature or latch 26. The latch 26 may be arcuately shaped or hook-like in the form of a J-shaped hook (see Figure 5) or L-shaped "hook" (such as shown in Figures 1 and 2), or may instead take on any configuration that is capable of providing sufficient retention and release of the second latch member 24.

In a preferred embodiment, at least a portion of the blocking member 24 is rotationally supported by the handle and is movable from a rest position to an activated position when activated by the activation member 20. For example, as generally illustrated, the blocking member 24 is configured as a bell crank having a first lever portion 24a, a second lever portion 24b and a pivot axle 40 (comprising two oppositely extending stub axles such as 40a, 40b) in Figure 1. An end portion 20a of the activation member 20 contacts or is operatively in communication with the first lever portion 24a (also identified as end portion 30) of the blocking

-6-

member 24. The bell crank and more particularly the stub axles 40a, 40b are rotationally supported in or relative to the handle 12. For example, each stub axle can be received within a bushing 13 formed in opposing sides 15 within a hollow end 12a of the handle 12 generally above the plunger 14. Alternate ways of rotationally supporting the blocking member are within the scope of the present invention. The lever 24b of the blocking member 24 is movable in and out of the notch 34 in the plunger 14.

Additionally, for some applications the first engagement surface 16 and the retaining feature 26 are configured to face away from one another or, for instance, they may contact diametrically opposing surfaces. Such a configuration can provide a measure of added safety in that if a force jars the assembly in a direction away from the engagement of the first or second retaining feature, the other feature may become further engaged and prevent an undesired release of the handle.

In a "locked" or "engaged" configuration, that is with a cooperating door (not shown) closed, such as shown in Figure 1, the retaining feature (latch) 26 of the blocking member 24 extends in locking engagement over, or is otherwise retained or movably restricted in at least one direction by a portion of retention surface 22. Ideally, there will be a sufficient overlap or interference in the desirably engaged configuration to prevent unintentional release or disengagement. It is however noted that although the exemplary retention surface 22 is illustrated in the nature of an outer ledge or edge surface, the retention surface 22 may instead take on other forms or configurations such as, for example, without limitation, a surface associated with a notch or a protrusion.

In the assembly 10 shown, upon engagement the retaining feature 26 and the retention surface 22 provide a mechanism to prevent the handle 12 from being pulled away from the door. One skilled in the art will appreciate the blocking member 24 can provide a measure of additional protection against unintended activation of the handle 12, for instance,

-7-

when a sufficiently high level of accelerative force (also referred to as a G-force) is applied in a direction normal to the handle.

The handle 12 is biased to a closed position by operation of a bell crank or bell crank mechanism 44 of conventional design, which is typically located within the door supporting the handle 12. The bell crank mechanism 44 includes a bell crank 45 having levers 45a, 45b, a first spring 46 and a pin 48. When the door (not shown) is closed, lever 45a biases the handle 12 via the first engagement surface 16 inwardly relative to the door to the closed or rest position of the handle. Phantom line 43 shows the force path of the lever 45a biasing the first engagement surface 16. Lever 45b is connected directly or indirectly via a cable or bar to the door latch of known variety. In the illustrated embodiments, it is not possible to merely lift the handle 12 and cause the door to unlatch and open while the latch feature 26 (of the blocking member) is maintained in a blocking position with surface 22 (see Figures 1 or 3) thereby preventing outward movement of the handle 12.

The latch 26 is moved to a release position that is disengaged from the retention surface 22 as a consequence of moving the activation member 20 inwardly and rotation of the blocking member 24. Sufficient mechanical movement of the activation member 20 causes the blocking member 24 rotate about axis 25. As the latch 26 moves it becomes disengaged from the retention surface 22. More particularly, inward movement (which is typically a pivot action) of the activation member 20 urges end 20a (of the activation member) to push end 30 of lever 24a upwards (further into the handle) against the bias force of a spring 50 (or 50a) mentioned below, which causes the retaining feature 26 to disengage from surface 22.

While not limited to the exemplary configuration of an assembly 10 shown, to unlatch the handle 12 in Figure 1, a user is generally required to pull the handle 12 and to actuate (e.g., push or depress) the trigger device 20 to unlatch the handle 12. If the user does not actuate the trigger device

-8-

20 and consequently the blocking member 24, the latch 26 will not disengage from the retention surface 22, and the handle 12 will generally be prevented from being pulled away from the retention surface 22.

In addition to the first or main spring 46, which is part of the bell crank 44, the assembly 10 includes a second spring means associated with the activation member (trigger device) 20 and blocking member. This second spring 50, 50a can take many forms and can be positioned within the hollow handle 12 to bias end 30 of the bell crank lever 24a in the direction of arrow 27 to rotate the bell crank in a counterclockwise direction (see arrow 27a) about axis 25. A leaf spring 50 is shown in Figure 1 while a helical spring 50a is shown in Figure 2.

From a force perspective, it is typically desired that the force associated with the main spring 46 is greater than the force associated with the second spring 50 or 50a, such that in engineering terms, there is less resistance or a lesser mechanical advantage associated with the lesser spring means. As used herein the term spring means may or may not include the inclusion of one or more springs, and may instead be comprised of other mechanical components that provide a spring-like effect.

Figure 2 illustrates an exploded view of an assembly 10. In addition to more specifically detailing certain features or nuances associated with some preferred embodiments of the components or elements already mentioned or discussed in connection with the assembly of the previous figure, the instant figure further depicts additional elements that can be employed. For instance, without limitation, Figure 2 generally illustrates an example of an additional, and optional, mating component 32 for interconnection or communication with and support of the handle 12. Component 32 assists in rotationally supporting the handle 12 relative to the door. Figure 2 depicts the plunger 14 being formed with a notch 34 (which is defined to include an aperture, recess, groove or notch) for receiving a portion of the blocking member 24. Phantom line 34a shows

-9-

the relative position of the second latch member relative to the handle and the notch 34. For example, on assembly the lever 24a is inserted within the hollow end 12a of the handle, and the axles 40a, 40b situated on the bearings 13 of the handle. The lever 24b of the blocking member 24 will be biased away from the notch 34 and will move in and out of the notch 34 relative to surface 22.

Figure 2 is an illustration of an embodiment of an optional separate bracket 36. The bracket 36 acts as a sleeve and is positioned in front of and about the sides of the plunger 14 and can be useful in eliminating or lessening sliding friction between the plunger 14 and the walls 28a about an opening in cap 28. In the preferred embodiment the bracket is made of a low-friction plastic. The bracket 36 can include a pivot surface 38 at its top, which provides for operational communication with the blocking member 24. One or more pivot surfaces 38a, 38b on the bracket 36 provide an alternate pivot point/surface (e.g., as a lever or rotation point) for supporting the stub axle portions of the blocking member 24. The stub axles 40a, 40b can extend over or otherwise be placed in mechanical connection with pivot surfaces 38a, 38b to permit the blocking member 14 to have a degree of movement or rotation about the pivot surface, and consequently, a portion of the blocking member 14 (e.g., latch 26) will have a degree of movement (linear or rotational) relative to the associated retention surface 22.

Figure 3 shows the handle assembly 10 in a configuration that corresponds to the door being shut. As depicted, latch feature 26 is engaged with retention surface 22 and will prohibit the movement of the handle 12 outwardly, such as away from the sheet metal forming the door 33 (shown in phantom line). Figure 4 shows the assembly in an unengaged configuration, which is achieved when the door is manually opened. The lever 24b of the blocking member 24 has been moved into the notch 34 of the plunger 14 and has disconnected from the surface 22.

-10-

Figures 5-7 illustrate an alternate embodiment of the invention including an alternate handle assembly 100 including a rotatable, spring biased handle 120. The handle 120 includes a hollow first end 122 adapted to mate with a corresponding connecting component such as a lock housing 128 (or cap 28 such as illustrated in Figures 1-4). The lock housing 128 is shown with an opening 129 therein to illustrate the location of an optional key cylinder, if used. The handle 120 includes an extending bar or plunger 114 with a corresponding optional engagement feature or surface 116 (also realized by a projecting structure) operatively connected to a bias spring such as 46. The plunger 114 includes a notch or hollow groove or slot 118a. This construction is similar to that shown in Figures 1- 4. The shape of the surface 116 (concave downward forming an L-shaped hook) differs from that of the shape of surface 16 (straight forming an L-shaped hook) but they are functional equivalents of each other. One of the levers such as 45a of the bell crank 45 exerts a downward bias force on the surface 116 as illustrated by arrow 174. The handle can be connected to the bias spring in alternate ways.

The handle 120 is generally hollow and includes a central, grasping or holding portion 130 that is formed as a thin, curved rib as illustrated in Figure 7. The rear or pivot end 132 of the handle 120 is rotationally supported in the door (shown as phantom line 133) in a known manner. The handle includes an integral pivot member 134 rotationally or slidingly received within a mating part of the door in a known manner. In Figures 5 and 7 the pivot member 134 is typically located below the sheet metal of the door 133. The handle assembly 100 includes an activation member or trigger 150. The activation member 150 is preferably a plastic molded lever and is pivotally connected to the handle 120 at a connection end 152 secured to the underside of end 132 of the handle.

The activation member 150 is secured to the handle by a pin or threaded fastener 154a (as shown in Figure 7). The activation member (trigger) 150 generally pivots about the fastener 154a (received through

-11-

opening 152a), which acts as a fulcrum. The trigger 150 includes an opposite end, which functions as an activation lever and is generally identified by numeral 154. Inward movement of the activation member, trigger or lever 150 moves the blocking member 160 to a release condition (similar to the manner in which blocking member 24 was moved). The blocking member 160 has, in general, the same function as member 24. The blocking member 160 includes a first lever 162 similar in function to lever 24a in the earlier embodiment. The blocking member 160 further includes another lever 164 similar in function to lever 24b. A retaining feature or latch 166 is formed at the distal end of lever 164 and is similar in function to retaining feature or latch 26, however, the shape of the retaining feature 166 is arcuate and includes a U-like or J-like shape. Blocking member 160 further includes two opposing stub axles 170 and 172 (shown in Figures 5, 6a and 6b), which are similar to axles 40a, 40b of the blocking member 24. For the purpose of illustration in Figure 7, the handle 120, plunger 114, and lock housing 128 are shown in cross-section while the activation member 150 and blocking member 160 are shown in isometric view. In Figures 6a and 6b, the blocking member 160 additionally includes a third stub axle 174, which extends only from one side thereof on which the torsion spring 180 is received.

The bias spring 180 includes a body 182 and ends 184, 186. Spring 180 is configured as a torsion spring having a central passage 188 through body 182. Spring 180 is mounted coaxially along an axis 174a (which extends through stub axle 174) and is received upon the stub axle 174 before the blocking member 160 is inserted within the end 122 of the handle 120. The spring 180 biases the latch 166 (blocking member) into engagement with retaining surface 22. One end of spring 180, such as 184, pushes on the blocking member 160 while another end of the spring, such as 186, is mounted within a cavity 123 forming hollow end 122 of handle 120 and reacts against an inner surface of this hollow end 122 causing the blocking member 160 to be biased in a counterclockwise

-12-

manner as shown by arrow 190 about axis 192 (which extends through the axles 170, 172) to place latch 166 in locking engagement with surface 22.

The blocking member 160 further includes an enlarged mass (inertial mass) portion 178 positioned between the axles 170, 172 and the lever 166. As shown in the various figures, this mass or inertial mass portion 176 is at or near the rear of lever 162 and positioned at the top of lever 164.

The operation of this embodiment is substantially similar to the earlier embodiment. When in a rest position the various parts will be configured as illustrated in Figure 7 with the blocking member (latch 166) in locking engagement about surface 22. In this rest portion, the bell crank lever 45a (or other bias mechanism) urges the handle toward the rest position. As illustrated, the lever 45a presses against plunger 114 (the upper surface of the retaining feature 116) urging the handle 120 to pivot into the interior volume of the door 133 and to rest against the door.

To release the door, during normal operation, the operator grasps the handle and more particularly applies an inward (relative to the handle) force (see arrow 200 of Figure 7 to the activation member 150), which causes the activation member 150 to pivot about its end 152. The motion of the activation member (trigger) 150 causes end 154 to push on end 162a (of lever 162) to lift lever 162 against the force bias spring 180, causing the blocking member (latch 166) to rotate relative to axis 192. Because of the geometry of the blocking member 160 and, in particular, the location of the axles 170, 172, the rotation of the blocking member 160 causes the latch 166 to move on an arc downwardly and away relative to latch surface 22. The disconnection of the latch 166 from surface 22 permits the user to then rotate or pull the handle 120 about its pivot 134, thereby causing the bell crank 45 to rotate in opposition to the bias force of its spring 46 to unlatch the latching or locking mechanism associated with the vehicle door and open the door.

-13-

During an accident inertial forces, see arrow 202 for example, act upon the door. The inertial force causes the blocking member 160 to move oppositely, such movement accentuated by the placement and weight of inertial mass 176, which urges the latch 166 to remain in contact with surface 22, thereby keeping the handle 120 in a locked condition and preventing the handle from inadvertently opening.

During assembly, the blocking member 160 and more particularly the axles 170, 172 are inserted within the hollow end 122. The handle 120 is formed at cavity 123. The hollow end includes a provision to rotationally support the axles 170, 172. For example, the cavity 123 is configured to include complementary bushing surfaces 210 (similar in function to bushings 13), shown in Figure 8, to rotationally receive the axles 170, 172. The axles are retained within the cavity 123 handle by a retention mechanism that can take a variety of forms such as a spring clip, a cotter pin, flexible tabs formed on the interior of the hollow end 122, or by retention pins 216 pressed through a wall 218 (or opening on the wall) of the handle after the axles 170, 172 are in place.

In Figure 7 the pivot end 132 of the handle and the lock housing 128 are each respectively shown positioned above a corresponding snap-in gasket or seal 220, 222 respectively which are placed on the door sheet metal adjacent to openings in the sheet metal. Each gasket 220, 222 acts as a seal between the handle 120 and lock housing 128 and the sheet metal of the vehicle door. Each shield 220, 222 includes an opening 224 (aligned with a corresponding opening in the door) through which a portion of the handle 120 and/or lock housing 128 extend. Each gasket 220, 222 includes one or more snap-in connectors 220a, 222a, which permits the gasket to be snapped into a corresponding opening (not shown) in the sheet metal of the door.

CLAIMS

1. A handle assembly (10, 100), comprising: a spring biased handle (12, 112); an activation member or trigger device (20, 150) in operative connection with the handle; a blocking member (24, 160) including a retaining feature (26, 166) configured to latch with retention surface (22), the blocking member moved by the activation member; wherein the blocking member is retained by a portion of the retention surface when the assembly is in a first configuration; and further wherein, upon sufficient movement of the activation member and the blocking member, the retaining feature is not restricted by the retention surface.

2. A handle assembly as recited in claim 1, wherein the handle includes a pivot end (32, 132) about which the handle can rotate, the handle further includes proximate an opposite end an extending member or plunger (14, 114), the extending member being configured to connect with a second handle member (28, 128).

3. A handle assembly as recited in claim 1, including at least one spring means (46, 50, 50a) for biasing at least one of the handle and the blocking member.

4. A handle assembly as recited in claim 3, wherein the assembly includes a first spring means for biasing the handle and a second spring means for biasing the blocking member, the force associated with the first spring means is greater than the force associated with the second spring means.

5. A handle assembly as recited in claim 2, wherein the retention surface is part of the second handle member and wherein the second

-15-

handle member is one of a cap (28) and lock housing (128), fixedly positioned relative to the handle.

6. A handle assembly as recited in claim 1, wherein the retaining feature (26, 166) includes one of a J-shaped latch, L-shaped latch, or curved latch.

7. A handle assembly as recited in claim 1, wherein the blocking member (24, 166) is rotatably supported in the handle and includes a portion in communication with the activation member and a portion that, in an engaged configuration, is in mechanical communication with the retention surface.

8. A handle assembly as recited in claim 1, wherein the handle includes an extending member, the extending member configured to extend from an underside of the handle through an opening in a cooperating door upon which the assembly is mounted, the extending member including a notch (34, 118a) configured to receive a portion of the blocking member.

9. A handle assembly as recited in claim 1, wherein the blocking member is comprised of a two-sided mechanical lever (24a, 24b; 162, 164).

10. A handle assembly as recited in claim 1, wherein the activation member includes one of a lever, button (23), or actuation mechanism.

11. A handle assembly as recited in claim 1, wherein the handle includes a plunger with an engagement surface and the blocking member includes a latch with hook-type feature, the engagement surface and the said hook-type feature substantially facing in opposing directions.

-16-

12. A handle assembly as recited in claim 1 wherein the blocking member includes an enlarged mass (176) proximate a pivot (40) thereof.

13. A handle assembly as recited in claim 1, including a support structure (36) that at least partially connects to or supports the blocking member.

14. A handle assembly as recited in claim 9, wherein the support structure includes at least one pivot surface.

2/8

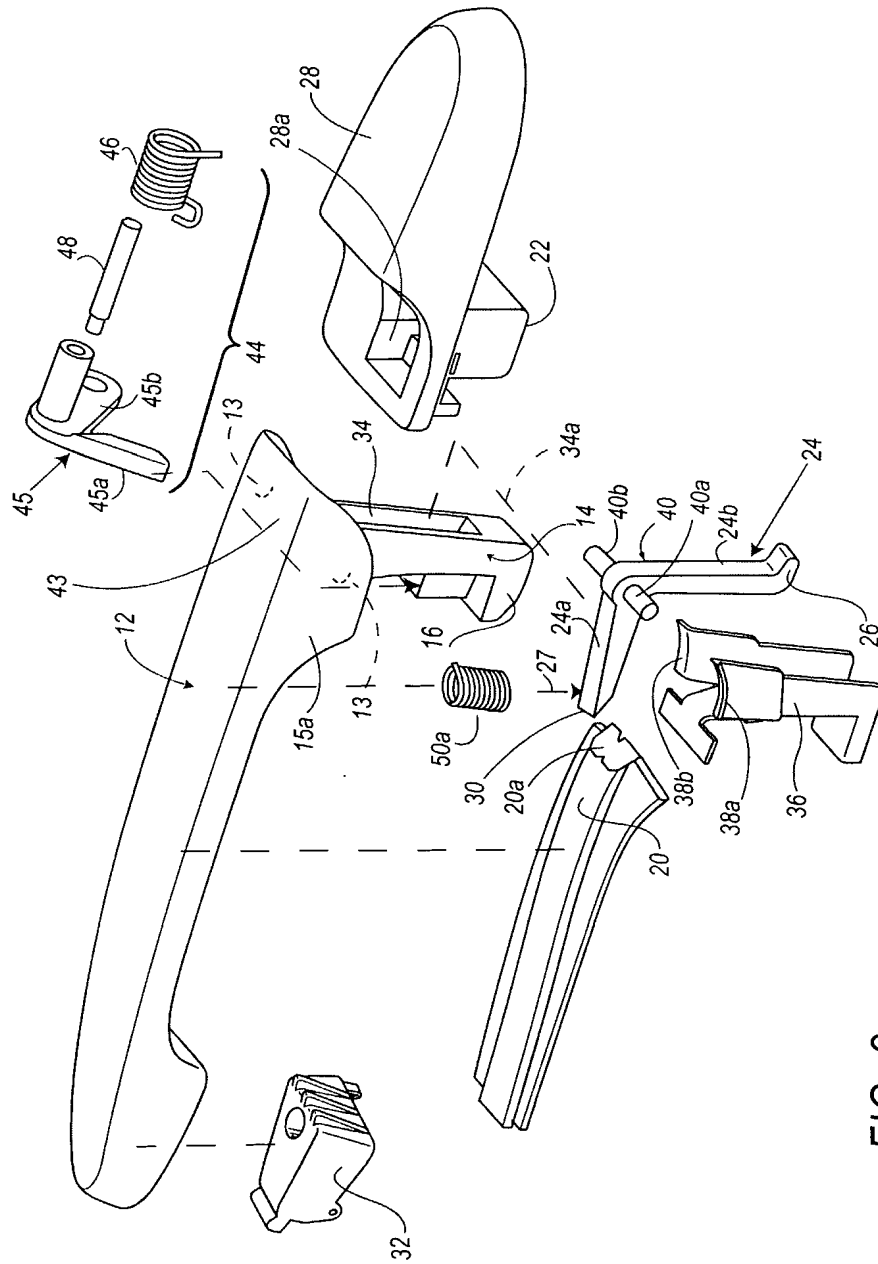
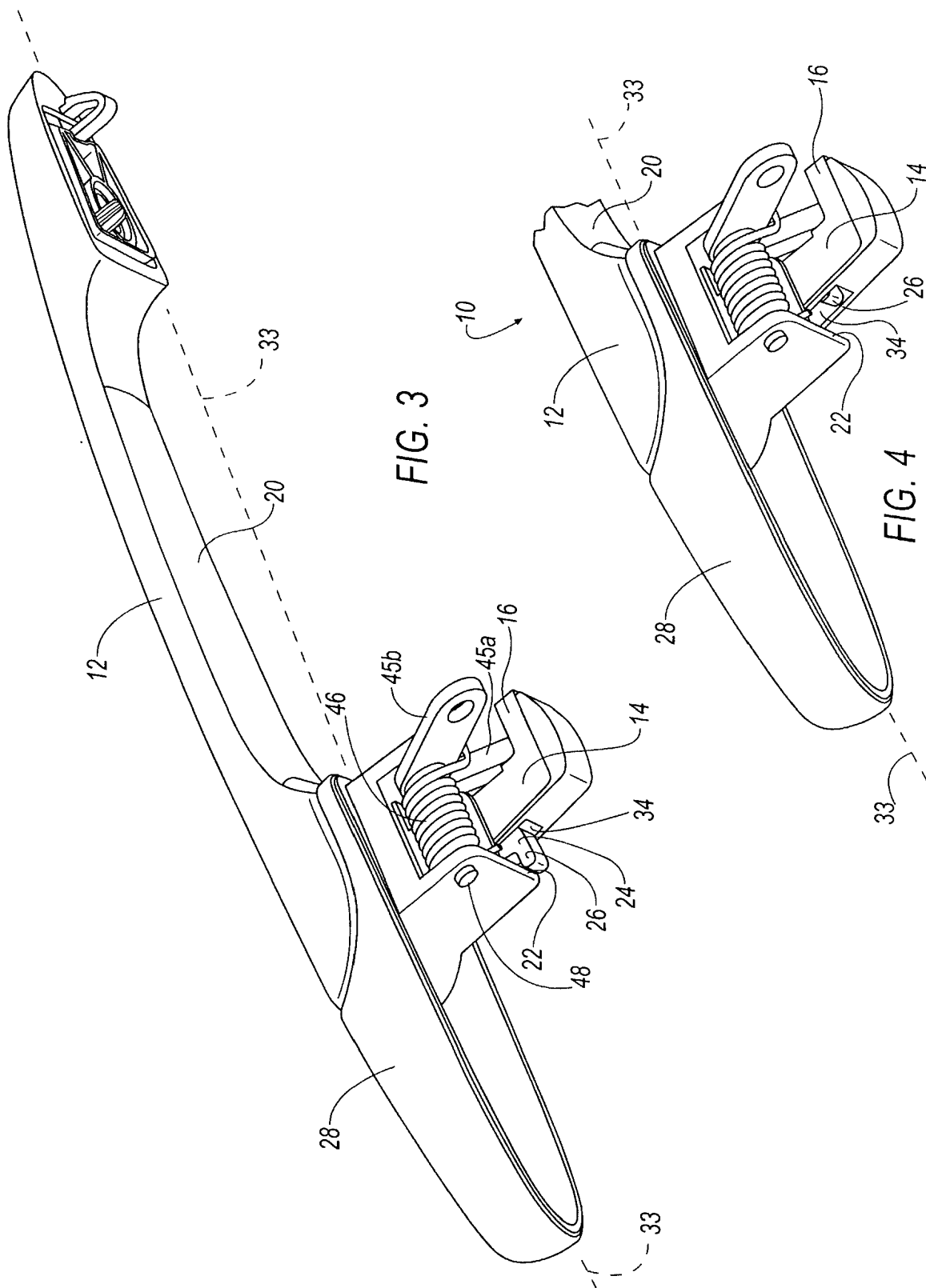


FIG. 2

3/8



4/8

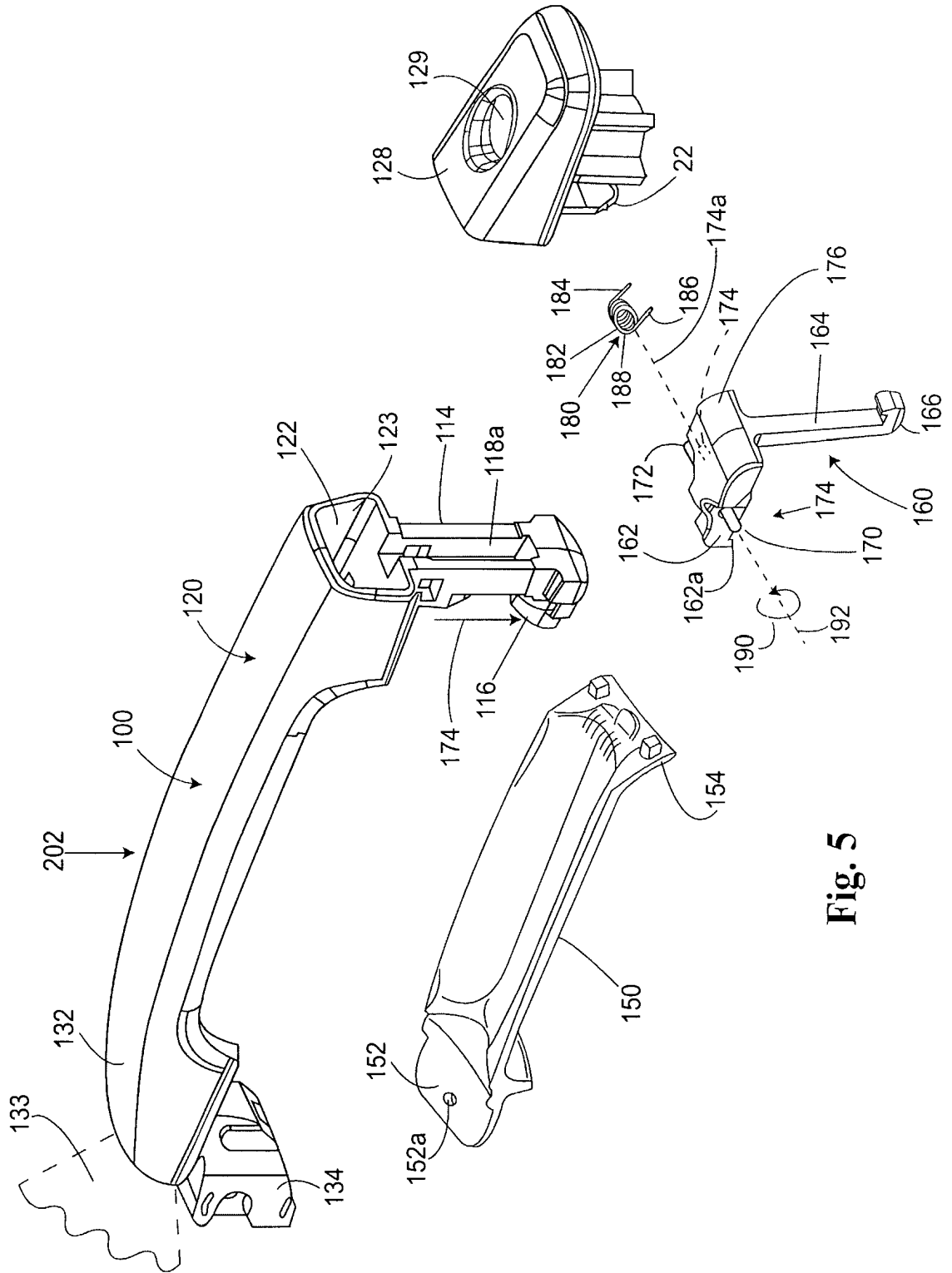
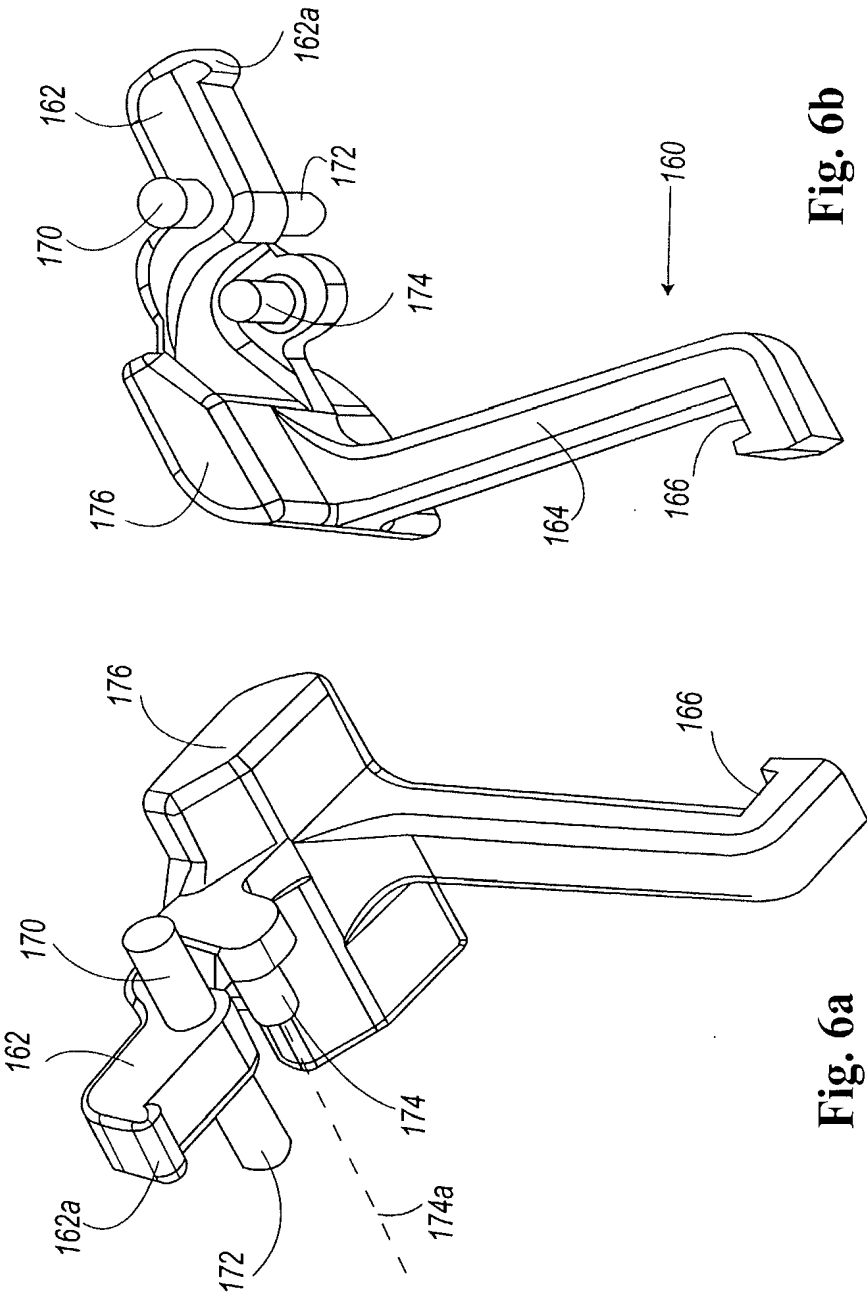


Fig. 5



6/8

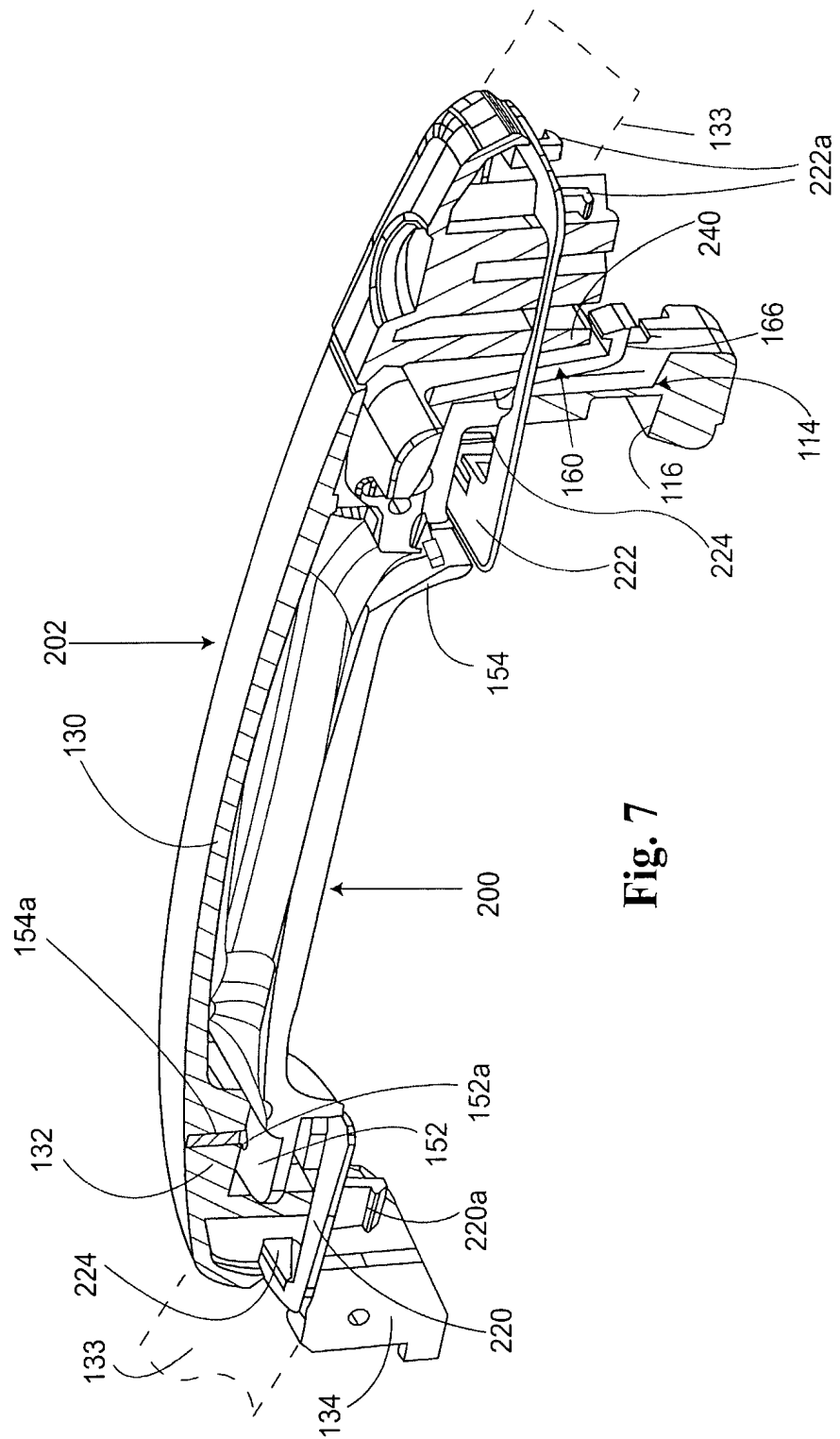


Fig. 7

7/8

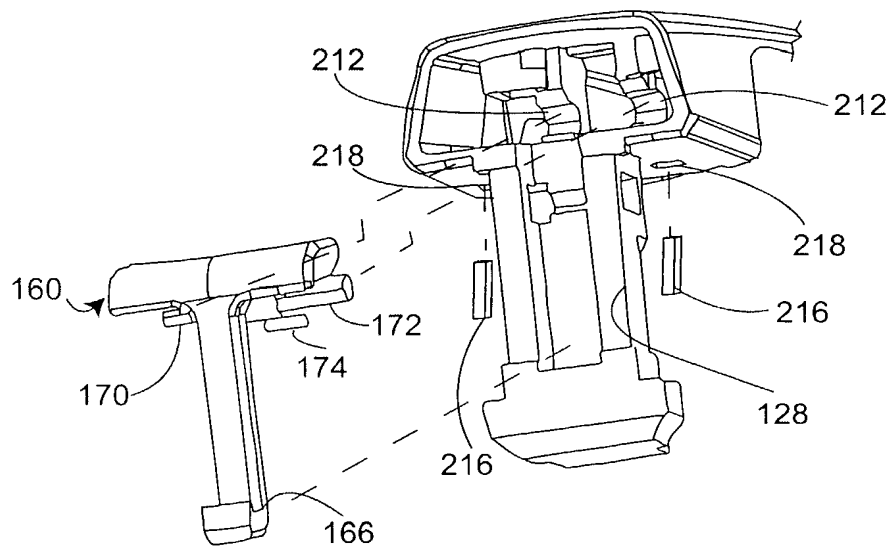


Fig. 8

INTERNATIONAL SEARCH REPORT

International Application No

T/US2004/027297

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 E05B65/12 E05B65/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 544 148 A (SANDOR BELA) 1 December 1970 (1970-12-01) column 2, line 17 - column 3, line 8; figures	1-14
X	US 5 560 659 A (DAULT ROBERT) 1 October 1996 (1996-10-01) abstract; figures	1-14
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☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No
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